Antenna structure for two overlapping frequency bands

The invention relates to an antenna structure as claimed in the precharacterizing clause of claim 1. An antenna structure such as this is known from AU 55898 73 A.

Antenna structures which are referred to by the expression "dual-band antennas" are known, for example, from the mobile radio field. Dual-band antennas such as these are designed to be suitable for transmission and reception within two mobile radio standard frequency bands which are separated from one another. One typical example is a dual-band antenna which can be used for the GSM 900 and GSM 1800 mobile radio standard frequency ranges. These two frequency bands do not overlap one another. In fact, the resultant antenna matching systems are in each case concentrated around the relevant mid-frequencies of the standard mobile radio frequency ranges. The dual-band antenna therefore has a high reactance in the vicinity of its resonant frequencies.

Two further standard frequency ranges are of major importance in mobile radio technology and are used in particular in the US American area. These are the EGSM 900 and EGSM 1900 mobile radio standard frequency ranges. As is obvious, the frequency bands of the GSM 850 and EGSM 900 standards and of the GSM 1800 and EGSM 1900 standards are each arranged adjacent to one another in the frequency spectrum. In this context, trials have already been carried out to develop comparatively broadband antennas for such adjacent mobile radio standard frequency ranges. In the field of internal antennas, that is to say antennas which are accommodated within a mobile radio housing, the following solution approaches for broadband antennas have already been investigated:

The antenna volume can be enlarged so as to produce broadband resonances. However, this has the disadvantage that more space must actually be provided for the antenna volume within a cellular telephone.

WO 01/82412 A1, for example, discloses multilayer internal antennas with a stacked structure with so-called "parasitic" antenna elements being arranged above and/or below a main antenna element and being electromagnetically coupled to the main antenna element, although they do not have their own RF supply connection. In order to reduce coupling so as to achieve broader antenna matching, long distances are required between the antenna elements, or the antenna elements have to be quite thick. Overall, an antenna structure such as this occupies quite a large volume, and this is actually undesirable for internal antennas for cellular telephones.

Furthermore, US 6,166,694 discloses an antenna structure for two resonant frequencies, that is to say for two frequency ranges, which has a single RF supply connection. The two frequency bands of the antenna structure described there cannot be overlapped.

EP 0 884 796 A2 discloses an antenna structure which is formed from bent or curved separations of a linear conductor. The antenna structures proposed there are all excited by a single RF supply line.

EP 1 376 761 A1 likewise describes antenna structures with broad antenna matching, which are excited via a single RF supply line.

Against this background, the invention is based on the object of developing an antenna structure of the type mentioned initially such that it requires a small antenna volume, while

the two frequency bands have a suitable overlap.

This object is achieved by an antenna structure of an essentially flat form with a ground connection and at least one RF supply connection, which is designed for use for at least two frequency bands, in which

Patent Claims

1. An antenna structure of an essentially flat form with a ground connection and at least one RF supply connection, which is designed for use for at least two frequency bands,
in which the antenna structure has two antenna branches (Z1, Z2), which are electrically conductively connected to a foot area (F), from the foot area (F) which surrounds the ground connection (P2),
two RF supply connections (P1, P3), which are arranged at a distance from one another, are provided in the foot area (F), between which the ground connection (P2) is provided, in that the antenna structure has an excitation circuit with an RF supply line (C), which branches to the two RF supply connections (P1, P3),
characterized
in that the two antenna branches (Z1, Z2) of the antenna structure are designed such that their associated frequency bands overlap, with the locations of the RF supply connections (P1, P3) and their distance from one another and to the ground connection (P2) each being matched to the desired frequency bands for the two antenna branches.

2. The antenna structure as claimed in claim 1,
characterized
in that the antenna structure is a planar, inverted F structure.

3. The antenna structure as claimed in claim 1 or 2,
characterized
in that the two antenna branches (Z1, Z2) of the antenna structure are each designed in a meandering shape.

4. The antenna structure as claimed in claim 3, characterized
in that the two antenna branches (Z1, Z2) are in the form of a double meander, in which one respective meander of an antenna branch engages in one meander of the other antenna branch, so that the two antenna branches (Z1, Z2) run essentially parallel to one another.

5. The antenna structure as claimed in one of claims 3 or 4, characterized in that the distance between the two meandering antenna branches (Z1, Z2) is in the range between 0.5 and 10 mm.

AMENDED CLAIMS

[Original claims 1-10 submitted to the International Office on April 6, 2004 (04.06.04) replaced by amended claims 1-5 (2 pages)]

1. An antenna structure of an essentially flat form with a ground connection and at least one RF supply connection, which is designed for use for at least two frequency bands, characterized
in that the antenna structure has two antenna branches (Z1, Z2), which are electrically conductively connected to a foot area (F), from the foot area (F) which surrounds the ground connection (P2),
two RF supply connections (P1, P3), which are arranged at a distance from one another, are provided in the foot area (F), and between which the ground connection (P2) is provided,
the two antenna branches (Z1, Z2) of the antenna structure are designed such that their associated frequency bands overlap, and
in that the antenna structure has an excitation circuit with an RF supply line (C), which branches to the two RF supply connections (P1, P3).

2. The antenna structure as claimed in claim 1, characterized
in that the antenna structure is a planar, inverted F structure.

3. The antenna structure as claimed in claim 1 or 2, characterized
in that the two antenna branches (Z1, Z2) of the antenna structure are each designed in a meandering shape.

4. The antenna structure as claimed in claim 3, characterized

in that the two antenna branches (Z1, Z2) are in the form of a double meander.

5. The antenna structure as claimed in one of claims 3 or 4, characterized in that the distance between the two meandering antenna branches (Z1, Z2) is in the range between 0.5 and 10 mm.